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THOMAS WILLIAM BRIDGE, 1848—1909.

THOMAS WILLIAM BRIDGE, the eldest son of the late Thomas Bridge, was born in Birmingham on November 5, 1848*. He received his early education at the Moseley School, and later attended science classes at the Midland Institute in Birmingham. In November, 1869, he became private assistant to Mr J. W. Clark, then Superintendent of the University Museum of Zoology at Cambridge, and now Registry of the University. He did not matriculate until 1871 and he entered Trinity College as a Foundation Scholar in 1873. A Demonstratorship of Comparative Anatomy having been established in the University in the latter year, Bridge was nominated to the post by the late Prof. Newton, his duties consisting in conducting a practical class in Comparative Anatomy, in addition to his work in the Museum. We are informed in the Annual Report of the Museums and Lecture Rooms Syndicate for 1873 that his class was well attended and that his pupils derived much profit from his instruction.

After graduating by means of the Natural Sciences Tripos (1875), Bridge spent six months at the Zoological Station at Naples. The outcome of this visit was the paper on the "Pori abdominales of Vertebrata." Returning to Cambridge, he again took up his duties as Demonstrator, and was engaged as before in teaching and curatorial work. The Cambridge Museum still possesses many admirable dissections, particularly osteological preparations of Fishes, which were prepared by him at this time and earlier.

In February, 1879, he was appointed, in succession to Dr. Leith Adams, F.R.S., to the Professorship of Zoology in the Royal College of Science for Ireland, vacating it a year later on his election to the Chair of Biology at Mason College, Birmingham, then just about to be opened. In 1882 he became the first Professor of Zoology in Mason College on the division of Biology into Zoology and Botany; and with the development of that institution into a University in 1900 he became Mason Professor of Zoology, a position he held until his death.

From 1880 onwards, as in his early life, Bridge's interests were entirely in Birmingham. His official duties naturally occupied a large proportion of his time, and his connection with a young and expanding institution rendered these claims so exacting as to give him but little leisure for research. It was no doubt mainly owing to this cause that the period between 1878 and 1888 was unproductive of scientific results. But he took a full share during that time in the organising work incidental to the growth of Mason College, acting as Secretary to the Academic Board in 1884—1886, and in later years occupying successively the Vice-chair and the Chair of that body.

* For many of the facts and dates recorded in this notice the writer is indebted to Miss Bridge and to an article contributed to the 'Birmingham Post' by Prof. J. H. Poynting, F.R.S.

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To his professorial work he throughout gave the utmost devotion. He was an excellent lecturer, and took special interest in the practical work carried on by his students.

Bridge was closely connected with the Birmingham Natural History Society and Philosophical Society, of both of which he filled the office of Vice-President, becoming the first President of the amalgamated Societies in 1894. He proceeded to the degree of Sc.D. (Cambridge) in 1896, and became a Fellow of the Royal Society in 1903. The degree of M.Sc. was conferred on him by the new University of Birmingham in 1901.

Bridge's scientific work all lay within a narrow compass. He was essentially a Morphologist, and his original papers refer to Fishes, especially to those which are usually regarded as occupying a low place in the Piscine series. He was thus particularly attracted to the "Ganoids" (a name which is now used in a somewhat more restricted sense than that in which he was accustomed to use it), to the Dipnoi and to the Siluroids, *Osteoglossum* and *Notopterus* among the Teleostei. "Let it be distinctly understood that the only sound foundation for scientific ichthyology is a profound *comparative* anatomy, and especially osteology of all the genera." These words, by Dr. T. Gill,* well express what may be supposed to have been Bridge's guiding motive throughout his work, which was always a judicious mixture of description and comparison of the structure of well-selected forms of Fishes.

During his residence at Cambridge he took up, jointly with his friend Mr. A. C. Haddon, the study of the remarkable relations that exist between the air-bladder and the auditory organ in the Siluridæ, as in certain other families of Teleostei which are grouped together as Ostariophysi. This resulted in a paper published in the 'Proceedings of the Royal Society' in 1889 and in a voluminous memoir which appeared in the 'Philosophical Transactions' in 1893. It was unfortunate, for various reasons, that the publication of this Memoir had been so long delayed.

The anatomical relations which form the subject of this joint paper are of no little interest. They were first described in 1820 by Weber, who showed that in the Siluridæ and Cyprinidæ a short chain of bones intervenes, on either side, between the anterior part of the air-bladder and the auditory organ, and regarded the air-bladder as thus accessory to the function of hearing. Bridge and Haddon, depending to a considerable extent on a part which had been purchased of Dr. Bleeker's well-known collection of East Indian Fishes, added greatly to our knowledge of the "Weberian ossicles" in the Siluridæ. No less than 100 species, referred to 51 genera, were examined. The view that the fishes possessing these ossicles are related to one another was fully confirmed, since the agreement throughout the Ostariophysi in regard to the ossicles is too detailed to permit of explanation on any other theory. The Weberian mechanism includes modifications of the auditory organ, of the air-bladder, and of the anterior part of the vertebral column. The axial skeleton in this

* 'Science' (N.S.), vol. 21, 1905, p. 661.

region has probably given rise to the ossicles, the homologies of which are carefully considered. A well-reasoned discussion of their functions follows.

It is a striking fact, as is pointed out by the authors, that "the presence of a Weberian mechanism is characteristic of nearly all the dominant families of fresh-water Teleostei"; and it might be supposed that its possessors derive "some exceptional advantage therefrom." What that advantage may be is not perfectly certain, in the absence of sufficient experimental evidence. The authors give weighty reasons for believing that the mechanism is not for the appreciation of the small vibrations which are concerned in producing an auditory stimulus, and conclude that it is probably to acquaint the fish, through the auditory organ, with the varying degrees of tension of the gaseous contents of the air-bladder due to variations in the height of the superincumbent column of water. It may be remarked that this manometer-like function of the Weberian mechanism has recently been supported by Thilo, who gives figures* showing the different positions assumed by the ossicles in a Carp with the air-bladder respectively tense and flaccid.

Of Bridge's other special Memoirs it is perhaps unnecessary to speak in detail, since they can hardly appeal to any except Vertebrate Morphologists. They include papers on the Skulls of *Amia*,† *Polypterus*, *Lepidosiren*, and *Osteoglossum*, on the Osteology of *Polyodon*, on the Mesial Fins of Ganoids and Teleosts, and on the Air-bladder and Auditory Organ of *Notopterus*.

Bridge's latest work was his article on Fishes in vol. 7 of 'The Cambridge Natural History,' and to this he devoted his best efforts. The writing of that article gave him the opportunity of putting together and making available for others his wide knowledge of the Morphology of Fishes, though other parts of the subject were by no means neglected. Although some of his statements have been criticised, the chapters contributed by Bridge to this volume are a most valuable summary of a very difficult subject. As one of the editors of the volume in question, the writer of this notice had many opportunities of admiring Bridge's devotion to his work, the trouble he would take to avoid carelessness or inaccuracy, and his keen desire to make his article as good as possible, without thought of any other considerations. He was, perhaps, unduly critical of his own performances, and was not satisfied to publish until he had made himself certain that he had done everything in his power to arrive at a correct result. This attitude of mind and the continued ill-health from which he suffered were no doubt responsible for the fact that his list of published papers is not a long one; though, on the other hand, there is probably nothing which he wrote that will not repay perusal. He was of a reserved nature, and there were not many persons who were admitted to his confidence. But those who knew him had a high respect for his thoroughness and his disinterested singleness of purpose. He died, unmarried, on June 29, 1909.

* 'Zool. Anzeiger,' vol. 32, 1908, p. 781.

† A list of the more important contributions is given at the end of this notice.

List of the Principal Publications of T. W. Bridge.

1. "The Cranial Osteology of *Amia calva*," 'Journ. Anat. and Physiol.,' vol. 11, 1877, p. 605.
2. "On the Osteology of *Polyodon folium*," 'Phil. Trans.,' vol. 169 (for 1878), 1879, p. 683.
3. "Pori abdominales of Vertebrata," 'Journ. Anat. and Physiol.,' vol. 14, 1879, p. 81.
4. "Some Points in the Cranial Anatomy of *Polypterus*," 'Proc. Birmingham Phil. Soc.,' vol. 6, Sessions 1887—88, 1888—89, p. 118.
5. "The Air-bladder in certain Siluroid Fishes," 't. cit.,' p. 131.
6. (With A. C. Haddon.) "The Air-bladder and Weberian Ossicles in the Siluroid Fishes," 'Roy. Soc. Proc.,' vol. 46, 1890, p. 309; vol. 52, 1893, p. 139; 'Phil. Trans.,' vol. 184, B, 1894, p. 65.
7. "On certain Features in the Skull of *Osteoglossum formosum*," 'Proc. Zool. Soc.,' 1895, p. 302.
8. "The Mesial Fins of Ganoids and Teleosts," 'J. Linn. Soc. (Zool.),' vol. 25, 1896, p. 530.
9. "On the Presence of Ribs in *Polyodon (Spatularia) folium*," 'Proc. Zool. Soc.,' 1897, p. 722.
10. "On the Morphology of the Skull in the Paraguayan *Lepidosiren* and in other Dipnoids," 'Trans. Zool. Soc.,' vol. 14, 1898, p. 325.
11. "The Air-bladder and its Connection with the Auditory Organ in *Notopterus borneensis*," 'J. Linn. Soc. (Zool.),' vol. 27, 1899—1900, p. 503.
12. Art.: "Fishes" (exclusive of the Systematic Account of Teleostei), 'The Cambridge Natural History,' vol. 7, 1904.

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